

1. Which of the following metric relationships is incorrect?
- [A] 1 microliter =  $10^{-6}$  liters                      [B] 10 decimeters = 1 meter  
[C]  $10^3$  milliliters = 1 liter                      [D] 1 gram =  $10^3$  kilograms  
[E] 1 gram =  $10^2$  centigrams
2. Which of the following is an example of a quantitative observation?
- [A] The temperature of the liquid is  $60^\circ\text{C}$ .  
[B] Solution 1 is much darker than solution 2.  
[C] The piece of metal is longer than the piece of wood.  
[D] The liquid in beaker A is blue.  
[E] At least two of these (a-d) are quantitative observations.
3. Express 0.00560 in exponential notation.
- [A]  $5.6 \times 10^{-3}$     [B] 5.60    [C]  $5.60 \times 10^3$     [D]  $5.60 \times 10^{-3}$     [E] none of these
4. A titration was performed to find the concentration of hydrochloric acid with the following results:
- | Trial | Molarity        |
|-------|-----------------|
| 1     | $1.25 \pm 0.01$ |
| 2     | $1.24 \pm 0.01$ |
| 3     | $1.26 \pm 0.01$ |
- The actual concentration of HCl was determined to be 1.000 M; the results of the titration are:
- [A] accurate but imprecise.                      [B] precise but inaccurate.  
[C] accuracy and precision are impossible to determine with the available information.  
[D] both inaccurate and imprecise.                      [E] both accurate and precise.
5. A scientist obtains the number 0.045006700 on a calculator. If this number actually has four (4) significant figures, how should it be written?
- [A] 0.4567            [B] 0.04501            [C] 0.4501            [D] 0.04500            [E] 0.045
6. How many significant figures are there in the number 3.1400?
- [A] 4                      [B] 3                      [C] 5                      [D] 2                      [E] 1



16. Convert 0.6571 m to mm.  
[A]  $6.571 \times 10^{-4}$  mm      [B] 0.06571 mm      [C]  $6.571 \times 10^{-3}$  mm  
[D] 657.1 mm      [E] none of these
17. One second contains this many picoseconds.  
[A]  $1 \times 10^{-12}$       [B]  $1 \times 10^{-9}$       [C]  $1 \times 10^9$       [D]  $1 \times 10^{15}$       [E]  $1 \times 10^{12}$
18. Convert 4301 mL to qts. (1 L = 1.06 qt)  
[A] 4559 qts      [B] 4058 qts      [C]  $4058 \times 10^{-3}$  qts      [D] 4.058 qts      [E] 4.559 qts
19. Convert 761 mi to km. (1 m = 1.094 yds, 1 mi = 1760 yds)  
[A]  $1.22 \times 10^9$  km      [B] 1220 km      [C] 832 km      [D] 696 km      [E] 1470 km
20. 423 Kelvin equals  
[A] 150. °C      [B] 696. °F      [C] 273. °F      [D] 150. °F      [E] 696. °C
21. In a recent accident some drums of uranium hexafluoride were lost in the English Channel. The melting point of uranium hexafluoride is 64.5°C. What is the melting point of uranium hexafluoride on the Fahrenheit scale? ( $T_F = T_C \times (9^\circ\text{F}/5^\circ\text{C}) + 32^\circ\text{F}$ )  
[A] 122°F      [B] 1.35°F      [C] 148°F      [D] 116°F      [E] 82.3°F
22. The boiling of water is a  
[A] chemical and physical damage.  
[B] chemical change because heat is needed for the process to occur.  
[C] chemical change because a gas (steam) is given off.  
[D] physical change because the gaseous water is chemically the same as the liquid.  
[E] physical change because the water merely disappears.
23. A solution is also called a  
[A] pure mixture.      [B] distilled mixture.      [C] homogeneous mixture.  
[D] compound.      [E] heterogeneous mixture.

24. An example of a pure substance is
- [A] compounds.                      [B] pure water.                      [C] carbon dioxide.  
[D] elements.                      [E] all of these
25. Which of the following pairs of compounds can be used to illustrate the law of multiple proportions?
- [A]  $\text{NH}_4$  and  $\text{NH}_4\text{Cl}$                       [B]  $\text{H}_2\text{O}$  and  $\text{HCl}$                       [C]  $\text{NO}$  and  $\text{NO}_2$   
[D]  $\text{CH}_4$  and  $\text{CO}_2$                       [E]  $\text{ZnO}_2$  and  $\text{ZnCl}_2$
26. Which of the following statements from Dalton's atomic theory is no longer true, according to modern atomic theory?
- [A] All atoms of a given element are identical.  
[B] Atoms are not created or destroyed in chemical reactions.  
[C] Elements are made up of tiny particles called atoms.  
[D] Atoms are indivisible in chemical reactions.  
[E] All of these statements are true according to modern atomic theory.
27. The first people to attempt to explain why chemical changes occur were
- [A] metallurgists.                      [B] alchemists.                      [C] the Greeks.  
[D] physicians.                      [E] physicists.
28. Which of the following pairs can be used to illustrate the law of multiple proportions?
- [A]  $\text{SO}$  and  $\text{SO}_2$                       [B]  $\text{KCl}$  and  $\text{KClO}_2$                       [C]  $\text{CO}$  and  $\text{CaCO}_3$   
[D]  $\text{H}_2\text{SO}_4$  and  $\text{H}_2\text{S}$                       [E]  $\text{H}_2\text{O}$  and  $\text{C}_{12}\text{H}_{22}\text{O}_{11}$
29. The first scientist to show that atoms emit any negative particles was
- [A] Lord Kelvin.                      [B] J. J. Thomson.                      [C] John Dalton.  
[D] William Thomson.                      [E] Ernest Rutherford.

30. Which one of the following statements about atomic structure is false?
- [A] The protons and neutrons in the nucleus are very tightly packed.
  - [B] Almost all of the mass of the atom is concentrated in the nucleus.
  - [C] The electrons occupy a very large volume compared to the nucleus.
  - [D] The number of protons and neutrons is always the same in the neutral atom.
  - [E] All of these statements (a-d) are true.
31. Rutherford's experiment was important because it showed that:
- [A] radioactive elements give off alpha particles.
  - [B] the mass of the atom is uniformly distributed throughout the atom.
  - [C] gold foil can be made to be only a few atoms thick.
  - [D] an atom is mostly empty space.
  - [E] a zinc sulfide screen scintillates when struck by a charged particle.
32. Which of the following name(s) is(are) correct?
1. sulfide  $S^{2-}$
  2. ammonium chloride  $NH_4Cl$
  3. acetic acid  $HC_2H_3O_2$
  4. barium oxide  $BaO$
- [A] all                      [B] none                      [C] 1, 3, 4                      [D] 1, 2                      [E] 3, 4
33. Which of the following atomic symbols is incorrect?
- [A]  ${}_{15}^{32}P$                       [B]  ${}_{8}^{14}N$                       [C]  ${}_{19}^{39}K$                       [D]  ${}_{6}^{14}C$                       [E]  ${}_{17}^{37}Cl$
34. The element rhenium (Re) exists as two stable isotopes and 18 unstable isotopes. Rhenium-185 has in its nucleus
- [A] 75 protons, 75 neutrons.                      [B] 75 protons, 110 neutrons.
  - [C] 130 protons, 75 neutrons.                      [D] not enough information is given.
  - [E] 75 protons, 130 neutrons.

35.  ${}^{40}_{20}\text{Ca}^{2+}$  has
- [A] 20 protons, 22 neutrons, and 18 electrons.
  - [B] 20 protons, 20 neutrons, and 22 electrons.
  - [C] 20 protons, 20 neutrons, and 18 electrons.
  - [D] 22 protons, 20 neutrons, and 20 electrons.
  - [E] 22 protons, 18 neutrons, and 18 electrons.
36. The numbers of protons, neutrons, and electrons in  ${}^{39}_{19}\text{K}^{+}$  are:
- [A] 20 p, 19 n, 19 e                      [B] 20 p, 19 n, 20 e                      [C] 19 p, 20 n, 19 e
  - [D] 19 p, 20 n, 20 e                      [E] 19 p, 20 n, 18 e
37. By knowing the number of protons a neutral atom has, you should be able to determine
- [A] the name of the atom.                      [B] the number of electrons in the neutral atom.
  - [C] the number of neutrons in the neutral atom.                      [D] two of these.
  - [E] none of these
38. How many oxygen atoms are there in one formula unit of  $\text{Ca}_3(\text{PO}_4)_2$ ?
- [A] 8                      [B] 6                      [C] 2                      [D] 4                      [E] none of these
39. Which metals form cations with varying positive charges?
- [A] Group 2 metals                      [B] metalloids                      [C] Group 1 metals
  - [D] transition metals                      [E] Group 3 metals
40. The correct name for  $\text{LiCl}$  is
- [A] monolithium monochloride                      [B] lithium (I) chloride
  - [C] lithium monochloride                      [D] lithium chloride                      [E] monolithium chloride
41. The correct name for  $\text{FeO}$  is
- [A] iron monoxide                      [B] iron (I) oxide                      [C] iron (III) oxide
  - [D] iron (II) oxide                      [E] iron oxide
42. The formula for calcium bisulfate is
- [A]  $\text{Ca}(\text{SO}_4)_2$                       [B]  $\text{CaS}_2$                       [C]  $\text{Ca}_2\text{HSO}_4$                       [D]  $\text{Ca}(\text{HSO}_4)_2$                       [E]  $\text{Ca}_2\text{S}$



Write the formula for:

50. dinitrogen trioxide

51. acetic acid

52. Bromine exists naturally as a mixture of bromine-79 and bromine-81 isotopes. An atom of bromine-79 contains

[A] 44 protons, 44 electrons, and 35 neutrons.

[B] 34 protons and 35 electrons, only.      [C] 35 protons, 44 neutrons, 35 electrons.

[D] 35 protons, 79 neutrons, and 35 electrons.

[E] 79 protons, 79 electrons, and 35 neutrons.

53. Gallium consists of two isotopes of masses 68.95 amu and 70.95 amu with abundances of 60.16% and 39.84%, respectively. What is the average atomic mass of gallium?

[A] 69.55

[B] 70.15

[C] 71.95

[D] 69.75

[E] 69.95



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Reference: 1.3

[1] [D]

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Reference: 1.2

[2] [A]

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Reference: 1.5

[3] [D]

---

Reference: 1.4

[4] [B]

---

Reference: 1.5

[5] [B]

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Reference: 1.5

[6] [C]

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Reference: 1.5,8

[7] [B]

---

Reference: 1.5

[8] [E]

---

Reference: 1.3

[9] [C]

---

Reference: 1.5

[10] [A]

---

Reference: 1.5

[11] [A]

---

Reference: 1.5

[12] [C]

---

Reference: 1.3

[13] [B]

---

Reference: 1.3

[14] [E]

---

Reference: 1.3

[15] [A]

---

Reference: 1.3

[16] [D]

---

Reference: 1.3

[17] [E]

---

Reference: 1.6

[18] [E]

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Reference: 1.6

[19] [B]

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Reference: 1.7

[20] [A]

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Reference: 1.7

[21] [C]

---

Reference: 1.9

[22] [D]

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Reference: 1.9  
[23] [C]

---

Reference: 1.9  
[24] [E]

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Reference: 2.2  
[25] [C]

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Reference: 2.3  
[26] [A]

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Reference: 2.1  
[27] [C]

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Reference: 2.2  
[28] [A]

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Reference: 2.4  
[29] [B]

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Reference: 2.4,5  
[30] [D]

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Reference: 2.4  
[31] [D]

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Reference: 2.8  
[32] [A]

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Reference: 2.5  
[33] [B]

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Reference: 2.5

[34] [B]

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Reference: 2.5

[35] [C]

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Reference: 2.5

[36] [E]

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Reference: 2.5

[37] [D]

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Reference: 2.8

[38] [A]

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Reference: 2.7,2.8

[39] [D]

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Reference: 2.8

[40] [D]

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Reference: 2.8

[41] [D]

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Reference: 2.8

[42] [D]

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Reference: 2.8

[43] [A]

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Reference: 2.8

[44] [E]

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Reference: 2.8

[45] [A]

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Reference: 2.8

[46] [C]

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Reference: 2.5

Symbol	# protons	# neutrons	# electrons	Net Charge
$^{206}_{82}\text{Pb}$	82	124	82	0
Ga	31	38	28	3+
Te	52	75	54	2-
Mn	25	29	23	2+

[47]

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Reference: 2.8

[48] carbon tetrachloride

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Reference: 2.8

[49] dinitrogen trioxide

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Reference: 2.8

[50]  $\text{N}_2\text{O}_3$

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Reference: 2.8

[51]  $\text{CH}_3\text{COOH}$

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Reference: 3.1

[52] [C]

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Reference: 3.1

[53] [D]